Complete Summary

GUIDELINE TITLE

ACC/AHA/ASE 2003 guideline update for the clinical application of echocardiography: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (ACC/AHA/ASE Committee to update the 1997 guidelines for the clinical application of echocardiography).

BIBLIOGRAPHIC SOURCE(S)

ACC/AHA/ASE 2003 guideline update for the clinical application of echocardiography: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines [trunc]. Bethesda (MD): American College of Cardiology Foundation; 2003. 99 p. [858 references]

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Cheitlin MD, Alpert JS, Armstrong WF, Aurigemma GP, Beller GA, Bierman FZ, Davidson TW, Davis JL, Douglas PS, Gillam LD, et al. ACC/AHA guidelines for the clinical application of echocardiography. A report of the American College of Cardiology American Heart Association Task Force on Practice Guidelines: Committee on Clinical Application of Echocardiography. Circulation 1997 Mar 18;95(6):1686-744.

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

- Adults with the following cardiovascular or pulmonary diseases or medical conditions:

    - Valvular heart disease
    - Murmurs
    - Angina
    - Ischemic heart disease
    - Cardiomyopathy
    - Congestive heart failure
    - Pericardial disease
    - Cardiac masses and tumors
    - Aortic diseases
    - Cardiopulmonary disease
    - Systemic hypertension
    - Neurologic disease and other cardioembolic disease
    - Arrhythmias and palpitation
    - Critical illness and trauma
    - Congenital heart disease
- Pediatric patients with the following cardiopulmonary diseases or medical conditions:
    - Congenital cardiovascular disease
    - Arrhythmias/conduction disturbances
    - Acquired cardiovascular disease
    - Cardiopulmonary disease
    - Thrombus/tumor
- Fetuses with cardiovascular disease

GUIDELINE CATEGORY

Assessment of Therapeutic Effectiveness
Diagnosis
Management
Risk Assessment
Screening

CLINICAL SPECIALTY

Cardiology
Family Practice
Internal Medicine
Pediatrics

INTENDED USERS

Health Care Providers

GUIDELINE OBJECTIVE(S)

- To provide assistance to physicians regarding the use of echocardiography in both the evaluation of specific cardiovascular disorders and in the evaluation of patients with frequently observed cardiovascular symptoms and signs, common presenting complaints, or findings of dyspnea, chest discomfort, and cardiac murmur by describing a range of generally acceptable approaches for the diagnosis, management, or prevention of specific diseases or conditions

- To identify specific circumstances when echocardiography adds little or nothing to the care of the patient and is therefore not indicated
- To develop and revise recommendations about the frequency with which an echocardiographic study is repeated
- To provide evidence in literature supporting the recommendations and using weight of evidence to classify the recommendations

TARGET POPULATION

Adults, adolescents, children, neonates, fetuses with cardiovascular disease

INTERVENTIONS AND PRACTICES CONSIDERED

1. Echocardiography
2. Doppler analysis
3. M-mode echocardiography
4. Two-dimensional echocardiography
5. Transthoracic echocardiography (TTE)
6. Transesophageal echocardiography (TEE)
7. Intraoperative echocardiography
8. Exercise (e.g., treadmill, upright or supine bicycle) stress echocardiography
9. Pharmacological (e.g., adrenergic-stimulating agents such as dobutamine, vasodilating agents such as dipyridamole or adenosine) stress echocardiography

MAJOR OUTCOMES CONSIDERED

- Diagnostic performance (test sensitivity, specificity, and accuracy of echocardiography for individual applications)
- Therapeutic impact and health related-outcomes of echocardiographic studies (morbidity and mortality from cardiovascular disease)

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Primary Sources)
Hand-searches of Published Literature (Secondary Sources)
Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

For this guideline update, literature searching was conducted in MEDLINE, EMBASE, Best Evidence, and the Cochrane Library for English-language meta-analyses and systematic reviews from 1995 through September 2001. Further searching was conducted for new clinical trials on the following topics: echocardiography in adult congenital heart disease, echocardiography for evaluation of chest pain in the emergency department, and intraoperative echocardiography. The new searches yielded more than 1,000 references that were reviewed by the writing committee.

The original recommendations of the 1997 guidelines are based on a Medline search of the English literature from 1990 to May 1995. Echocardiography was cross-referenced with the following terms: antineoplastic agents, aortic or dissecting aneurysm, arrhythmias, athletes, atrial fibrillation, cardioversion, Marfan syndrome, bacterial endocarditis, myocardial infarction, myocardial ischemia, coronary disease, chest pain, cardiomyopathies, cerebrovascular disorders or cerebral ischemia, embolism, heart neoplasms, heart valve disease, heart murmurs, hypertension, mitral valve prolapse, pericarditis, pericardial effusion, cardiac tamponade, pericardium, pulmonary embolism or pulmonary heart disease or cor pulmonale, screening, shock or aortic rupture or heart rupture, syncope, transplantation, unstable angina, congenital heart disease in the adult specific congenital lesions, arrhythmias in children, pediatric echocardiography, and fetal echocardiography. The original search yielded over 3000 references.

NUMBER OF SOURCE DOCUMENTS

More than 4,000

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Not stated

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Review of Published Meta-Analyses
Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

For the original guideline the committee conducted a systematic review with evaluation of the available clinical data and compilation of these data into evidence tables. For this update, each section has been reviewed and evidence tables updated where appropriate.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Experts in the subject under consideration are selected from both the American College of Cardiology and the American Heart Association to examine subject-specific data and write guidelines. The process includes additional representatives from other medical practitioner and specialty groups as appropriate. Writing

groups are specifically charged to perform a formal literature review, weigh the strength of evidence for or against a particular treatment or procedure, and include estimates of expected health outcomes where data exist. Patient-specific modifiers, comorbidities, and issues of patient preference that might influence the choice of particular tests or therapies are considered, as well as frequency of follow-up and cost-effectiveness.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

The recommendations concerning the use of echocardiography follow the recommendation classification system (e.g., Classes I, II, and III) used in other American College of Cardiology/American Heart Association guidelines:

Class I: Conditions for which there is evidence and/or general agreement that a given procedure or treatment is useful and effective

Class II: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment

Class IIa: Weight of evidence/opinion is in favor of usefulness/efficacy.

Class IIb: Usefulness/efficacy is less well established by evidence/opinion.

Class III: Conditions for which there is evidence and/or general agreement that the procedure/treatment is not useful/effective and in some cases may be harmful*

*Because it is not likely that harm will occur by performing an echocardiogram, the reason for the Class III designation in the original guideline document is almost exclusively that there is no evidence that performing an echocardiogram has been shown to be helpful.

COST ANALYSIS

Stress Echocardiography

- Compared with standard treadmill exercise testing, stress echocardiography is of significant additive clinical value for detecting and localizing inducible myocardial ischemia. Moreover, when the pretest probability is in the intermediate range, stress echocardiography may be more cost-effective for identifying the presence or absence of coronary artery disease (CAD) than conventional exercise testing
- Several studies, although uncorrected for referral bias, do suggest that stress echocardiography may be a cost-effective diagnostic strategy in women with an intermediate pretest probability of CAD, because it allows avoidance of inappropriate angiography.

In addition, the guideline developers examined published cost-effectiveness analyses for:

- Doppler echocardiography in adults with symptomatic aortic stenosis

- Echocardiography and electrocardiography for detection of left ventricular hypertrophy in patients with systemic hypertension.
- Transesophageal echocardiography to determine the duration of therapy for intravascular catheter-associated *Staphylococcus aureus* bacteremia
- Echocardiographic identification of cardiovascular sources of emboli to guide clinical management of stroke
- Screening of high school athletes for risk of sudden cardiac death

METHOD OF GUIDELINE VALIDATION

External Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The document was reviewed by two outside reviewers nominated by the American College of Cardiology (ACC), two outside reviewers nominated by the American Heart Association (AHA), and two outside reviewers nominated by the American Society of Echocardiography (ASE). The guideline was approved for publication by the American College of Cardiology Board of Trustees in May 2003, the American Heart Association Science Advisory and Coordinating Committee in May 2003, and the American Society of Echocardiography in May 2003.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Levels of recommendation (I-III) are defined at the end of the "Major Recommendations" field.

Recommendations for Echocardiography in the Evaluation of Patients With a Heart Murmur

Class I

1. A patient with a murmur and cardiorespiratory symptoms
2. An asymptomatic patient with a murmur in whom clinical features indicate at least a moderate probability that the murmur is reflective of structural heart disease

Class IIa

A murmur in an asymptomatic patient in whom there is a low probability of heart disease but in whom the diagnosis of heart disease cannot be reasonably excluded by the standard cardiovascular clinical evaluation

Class III

In an asymptomatic adult, a heart murmur that has been identified by an experienced observer as functional or innocent

Recommendations for Echocardiography in Valvular Stenosis

Class I

1. Diagnosis; assessment of hemodynamic severity
2. Assessment of left ventricular (LV) and right ventricular (RV) size, function, and/or hemodynamics
3. Re-evaluation of patients with known valvular stenosis with changing symptoms or signs
4. Assessment of changes in hemodynamic severity and ventricular compensation in patients with known valvular stenosis during pregnancy
5. Re-evaluation of asymptomatic patients with severe stenosis

Class IIa

1. Assessment of the hemodynamic significance of mild to moderate valvular stenosis by stress Doppler echocardiography
2. Re-evaluation of patients with mild to moderate aortic stenosis with LV dysfunction or hypertrophy even without clinical symptoms

Class IIb

1. Re-evaluation of patients with mild to moderate aortic valvular stenosis with stable signs and symptoms
2. Dobutamine echocardiography for the evaluation of patients with low-gradient aortic stenosis and ventricular dysfunction

Class III

1. Routine re-evaluation of asymptomatic adult patients with mild aortic stenosis having stable physical signs and normal LV size and function
2. Routine re-evaluation of asymptomatic patients with mild to moderate mitral stenosis and stable physical signs

(See also "Recommendations for Echocardiography in Interventions for Valvular Heart Disease and Prosthetic Valves.")

Recommendations for Echocardiography in Native Valvular Regurgitation

Class I

1. Diagnosis; assessment of hemodynamic severity
2. Initial assessment and re-evaluation (when indicated) of LV and RV size, function, and/or hemodynamics
3. Re-evaluation of patients with mild to moderate valvular regurgitation with changing symptoms
4. Re-evaluation of asymptomatic patients with severe regurgitation
5. Assessment of changes in hemodynamic severity and ventricular compensation in patients with known valvular regurgitation during pregnancy
6. Re-evaluation of patients with mild to moderate regurgitation with ventricular dilation without clinical symptoms

7. Assessment of the effects of medical therapy on the severity of regurgitation and ventricular compensation and function when it might change medical management
8. Assessment of valvular morphology and regurgitation in patients with a history of anorectic drug use, or the use of any drug or agent known to be associated with valvular heart disease, who are symptomatic, have cardiac murmurs, or have a technically inadequate auscultatory examination

Class IIb

1. Re-evaluation of patients with mild to moderate mitral regurgitation without chamber dilation and without clinical symptoms
2. Re-evaluation of patients with moderate aortic regurgitation without chamber dilation and without clinical symptoms

Class III

1. Routine re-evaluation in asymptomatic patients with mild valvular regurgitation having stable physical signs and normal LV size and function
2. Routine repetition of echocardiography in past users of anorectic drugs with normal studies or known trivial valvular abnormalities

(See also "Recommendations for Echocardiography in Interventions for Valvular Heart Disease and Prosthetic Valves.")

Recommendations for Echocardiography in Mitral Valve Prolapse (MVP)

Class I

Diagnosis; assessment of hemodynamic severity, leaflet morphology, and/or ventricular compensation in patients with physical signs of MVP

Class IIa

1. To exclude MVP in patients who have been diagnosed but without clinical evidence to support the diagnosis
2. To exclude MVP in patients with first-degree relatives with known myxomatous valve disease
3. Risk stratification in patients with physical signs of MVP or known MVP

Class III

1. Exclusion of MVP in patients with ill-defined symptoms in the absence of a constellation of clinical symptoms or physical findings suggestive of MVP or a positive family history
2. Routine repetition of echocardiography in patients with MVP with no or mild regurgitation and no changes in clinical signs or symptoms

Recommendations for Echocardiography in Infective Endocarditis: Native Valves

Class I

1. Detection and characterization of valvular lesions, their hemodynamic severity, and/or ventricular compensation*
2. Detection of vegetations and characterizations of lesions in patients with congenital heart disease suspected of having infective endocarditis
3. Detection of associated abnormalities (e.g., abscesses, shunts)*
4. Re-evaluation studies in complex endocarditis (e.g., virulent organism, severe hemodynamic lesion, aortic valve involvement, persistent fever or bacteremia, clinical change, or symptomatic deterioration)
5. Evaluation of patients with high clinical suspicion of culture-negative endocarditis*
6. If transthoracic echocardiography (TTE) is equivocal, transesophageal echocardiography (TEE) evaluation of bacteremia, especially staphylococcus bacteremia and fungemia without a known source

Class IIa

1. Evaluation of persistent nonstaphylococcus bacteremia without a known source*
2. Risk stratification in established endocarditis*

Class IIb

Routine re-evaluation in uncomplicated endocarditis during antibiotic therapy

Class III

Evaluation of transient fever without evidence of bacteremia or new murmur

*TEE may frequently provide incremental value in addition to information obtained by TTE. The role of TEE in first-line examination awaits further study.

Recommendations for Echocardiography in Interventions for Valvular Heart Disease and Prosthetic Valves

Class I

1. Assessment of the timing of valvular intervention based on ventricular compensation, function, and/or severity of primary and secondary lesions
2. Selection of alternative therapies for mitral valve disease (such as balloon valvuloplasty, operative valve repair, valve replacement)*
3. Use of echocardiography (especially TEE) in guiding the performance of interventional techniques and surgery (e.g., balloon valvotomy and valve repair) for valvular disease
4. Postintervention baseline studies for valve function (early) and ventricular remodeling (late)
5. Re-evaluation of patients with valve replacement with changing clinical signs and symptoms; suspected prosthetic dysfunction (stenosis, regurgitation) or thrombosis*

Class IIa

Routine re-evaluation study after baseline studies of patients with valve replacements with mild to moderate ventricular dysfunction without changing clinical signs or symptoms

Class IIb

Routine re-evaluation at the time of increased failure rate of a bioprosthesis without clinical evidence of prosthetic dysfunction

Class III

1. Routine re-evaluation of patients with valve replacements without suspicion of valvular dysfunction and with unchanged clinical signs and symptoms
2. Patients whose clinical status precludes therapeutic interventions

*TEE may provide incremental value in addition to information obtained by TTE.

Recommendations for Echocardiography in Infective Endocarditis: Prosthetic Valves

Class I

1. Detection and characterization of valvular lesions, their hemodynamic severity, and/or ventricular compensation*
2. Detection of associated abnormalities (e.g., abscesses, shunts)*
3. Re-evaluation in complex endocarditis (e.g., virulent organism, severe hemodynamic lesion, aortic valve involvement, persistent fever or bacteremia, clinical change, or symptomatic deterioration)*
4. Evaluation of suspected endocarditis and negative cultures*
5. Evaluation of bacteremia without known source*

Class IIa

Evaluation of persistent fever without evidence of bacteremia or new murmur*

Class IIb

Routine re-evaluation in uncomplicated endocarditis during antibiotic therapy*

Class III

Evaluation of transient fever without evidence of bacteremia or new murmur

*TEE may provide incremental value in addition to that obtained by TTE.

Recommendations for Echocardiography in Patients With Chest Pain

Class I

1. Diagnosis of underlying cardiac disease in patients with chest pain and clinical evidence of valvular, pericardial, or primary myocardial disease (see sections II, IV through VI, VIII, and IX in the original guideline document)
2. Evaluation of chest pain in patients with suspected acute myocardial ischemia, when baseline electrocardiogram (ECG) and other laboratory markers are nondiagnostic and when study can be obtained during pain or within minutes after its abatement (see section IV in the original guideline document)
3. Evaluation of chest pain in patients with suspected aortic dissection (see section VIII in the original guideline document)
4. Evaluation of patients with chest pain and hemodynamic instability unresponsive to simple therapeutic measures (see section XIII in the original guideline document)

Class III

1. Evaluation of chest pain for which a noncardiac etiology is apparent
2. Diagnosis of chest pain in a patient with electrocardiographic changes diagnostic of myocardial ischemia/infarction (see section IV in the original guideline document)

Recommendations for Echocardiography in the Diagnosis of Acute Myocardial Ischemic Syndromes

Class I

1. Diagnosis of suspected acute ischemia or infarction not evident by standard means
2. Measurement of baseline LV function
3. Evaluation of patients with inferior myocardial infarction and clinical evidence suggesting possible RV infarction
4. Assessment of mechanical complications and mural thrombus*

Class IIa

Identification of location/severity of disease in patients with ongoing ischemia

Class III

Diagnosis of acute myocardial infarction already evident by standard means

*TEE is indicated when TTE studies are not diagnostic.

Recommendations for Echocardiography in Risk Assessment, Prognosis, and Assessment of Therapy in Acute Myocardial Ischemic Syndromes

Class I

1. Assessment of infarct size and/or extent of jeopardized myocardium
2. In-hospital assessment of ventricular function when the results are used to guide therapy

3. In-hospital or early postdischarge assessment of the presence/extent of inducible ischemia whenever baseline abnormalities are expected to compromise electrocardiographic interpretation*
4. Assessment of myocardial viability when required to define potential efficacy of revascularization**

Class IIa

1. In-hospital or early postdischarge assessment of the presence/extent of inducible ischemia in the absence of baseline abnormalities expected to compromise ECG interpretation*
2. Re-evaluation of ventricular function during recovery when results are used to guide therapy
3. Assessment of ventricular function after revascularization

Class IIb

Assessment of late prognosis (greater than or equal to 2 years after acute myocardial infarction)

Class III

Routine re-evaluation in the absence of any change in clinical status

*Exercise or pharmacological stress echocardiogram

**Dobutamine stress echocardiogram

Recommendations for Echocardiography in Diagnosis and Prognosis of Chronic Ischemic Heart Disease

Class I

1. Diagnosis of myocardial ischemia in symptomatic individuals*
2. Exercise echocardiography for diagnosis of myocardial ischemia in selected patients (those where ECG assessment is less reliable because of digoxin use, left ventricular hypertrophy [LVH] or with more than 1-mm ST depression at rest on the baseline ECG, those with pre-excitation [Wolff- Parkinson-White] syndrome, complete left bundle-branch block) with an intermediate pretest likelihood of coronary artery disease (CAD)
3. Assessment of global ventricular function at rest
4. Assessment of myocardial viability (hibernating myocardium) for planning revascularization**
5. Assessment of functional significance of coronary lesions (if not already known) in planning percutaneous transluminal coronary angioplasty*

Class IIa

1. Prognosis of myocardial ischemia in selected patients (those in whom ECG assessment is less reliable) with the following ECG abnormalities: pre-excitation (Wolff-Parkinson-White) syndrome, electronically-paced ventricular

rhythm, more than 1 mm of ST depression at rest, complete left bundle-branch block*
2. Detection of coronary arteriopathy in patients who have undergone cardiac transplantation**
3. Detection of myocardial ischemia in women with an intermediate pretest likelihood of CAD*

Class IIb

1. Assessment of an asymptomatic patient with positive results from a screening treadmill test*
2. Assessment of global ventricular function with exercise*

Class III

1. Screening of asymptomatic persons with a low likelihood of CAD
2. Routine periodic reassessment of stable patients for whom no change in therapy is contemplated
3. Routine substitution for treadmill exercise testing in patients for whom ECG analysis is expected to suffice*

*Exercise or pharmacological stress echocardiogram

**Dobutamine stress echocardiogram

Recommendations for Echocardiography in Assessment of Interventions in Chronic Ischemic Heart Disease

Class I

1. Assessment of LV function when needed to guide institution and modification of drug therapy in patients with known or suspected LV dysfunction
2. Assessment for restenosis after revascularization in patients with atypical recurrent symptoms*

Class IIa

1. Assessment for restenosis after revascularization in patients with typical recurrent symptoms*
2. Assessment of LV function in patients with previous myocardial infarction when needed to guide possible implantation of implantable cardioverter-defibrillator (ICD) in patients with known or suspected LV dysfunction

Class III

Routine assessment of asymptomatic patients after revascularization

*Exercise or pharmacological stress echocardiography

Recommendations for Echocardiography in Patients With Dyspnea, Edema, or Cardiomyopathy

Class I

1. Assessment of LV size and function in patients with suspected cardiomyopathy or clinical diagnosis of heart failure*
2. Edema with clinical signs of elevated central venous pressure when a potential cardiac etiology is suspected or when central venous pressure cannot be estimated with confidence and clinical suspicion of heart disease is high*
3. Dyspnea with clinical signs of heart disease
4. Patients with unexplained hypotension, especially in the intensive care unit*
5. Patients exposed to cardiotoxic agents, to determine the advisability of additional or increased dosages
6. Re-evaluation of LV function in patients with established cardiomyopathy when there has been a documented change in clinical status or to guide medical therapy
7. Suspicion of hypertrophic cardiomyopathy based on abnormal physical examination, ECG, or family history
8. Contrast echocardiographic assessment of myocardial infarct zone during interventional septal alcohol ablation studies

Class IIb

1. Re-evaluation of patients with established cardiomyopathy when there is no change in clinical status but where the results might change management
2. Re-evaluation of patients with edema when a potential cardiac cause has already been demonstrated

Class III

1. Evaluation of LV ejection fraction in patients with recent (contrast or radionuclide) angiographic determination of ejection fraction
2. Routine re-evaluation in clinically stable patients in whom no change in management is contemplated and for whom the results would not change management
3. In patients with edema, normal venous pressure, and no evidence of heart disease

*TEE is indicated when TTE studies are not diagnostic.

Recommendations for Echocardiography in Pericardial Disease

Class I

1. Patients with suspected pericardial disease, including effusion, constriction, or effusive-constrictive process
2. Patients with suspected bleeding in the pericardial space (e.g., trauma, perforation)
3. Follow-up study to evaluate recurrence of effusion or to diagnose early constriction. Repeat studies may be goal directed to answer a specific clinical question.

4. Pericardial friction rub developing in acute myocardial infarction accompanied by symptoms such as persistent pain, hypotension, and nausea

Class IIa

1. Follow-up studies to detect early signs of tamponade in the presence of large or rapidly accumulating effusions. A goal-directed study may be appropriate.
2. Echocardiographic guidance and monitoring of pericardiocentesis

Class IIb

1. Postsurgical pericardial disease, including postpericardiotomy syndrome, with potential for hemodynamic impairment
2. In the presence of a strong clinical suspicion and nondiagnostic TTE, TEE assessment of pericardial thickness to support a diagnosis of constrictive pericarditis

Class III

1. Routine follow-up of small pericardial effusion in clinically stable patients
2. Follow-up studies in patients with cancer or other terminal illness for whom management would not be influenced by echocardiographic findings
3. Assessment of pericardial thickness in patients without clinical evidence of constrictive pericarditis
4. Pericardial friction rub in early uncomplicated myocardial infarction or in the early postoperative period after cardiac surgery

Recommendations for Echocardiography in Patients With Cardiac Masses and Tumors

Class I

1. Evaluation of patients with clinical syndromes and events that suggest an underlying cardiac mass
2. Evaluation of patients with underlying cardiac disease known to predispose to mass formation for whom a therapeutic decision regarding surgery or anticoagulation will depend on the results of echocardiography
3. Follow-up or surveillance studies after surgical removal of masses known to have a high likelihood of recurrence (i.e., myxoma)
4. Patients with known primary malignancies when echocardiographic surveillance for cardiac involvement is part of the disease staging process

Class IIb

Screening persons with disease states likely to result in mass formation but for whom no clinical evidence for the mass exists

Class III

Patients for whom the results of echocardiography will have no impact on diagnosis or clinical decision making

Recommendations for Echocardiography in Suspected Thoracic Aortic Disease

Class I

1. Aortic dissection, diagnosis, location, and extent
2. Aortic aneurysm*
3. Aortic intramural hematoma
4. Aortic rupture
5. Aortic root dilation in Marfan syndrome or other connective tissue syndromes*
6. Degenerative or traumatic aortic disease with clinical atheroembolism
7. Follow-up of aortic dissection, especially when complication or progression is suspected
8. First-degree relative of a patient with Marfan syndrome or other connective tissue disorder for which TTE is recommended* (see section XIIa in the original guideline document)

Class IIa

Follow-up of a patient with surgically repaired aortic dissection*

*TTE should be the first choice in these situations, and TEE should only be used if the examination is incomplete or additional information is needed.

Note: TEE is the technique that is indicated in examination of the entire aorta, especially in emergency situations.

Recommendations for Echocardiography in Pulmonary and Pulmonary Vascular Disease

Class I

1. Suspected pulmonary hypertension
2. For distinguishing cardiac versus noncardiac etiology of dyspnea in patients in whom all clinical and laboratory clues are ambiguous*
3. Follow-up of pulmonary artery pressures in patients with pulmonary hypertension to evaluate response to treatment
4. Lung disease with clinical suspicion of cardiac involvement (suspected cor pulmonale)

Class IIa

1. Pulmonary emboli and suspected clots in the right atrium or ventricle or main pulmonary artery branches*
2. Measurement of exercise pulmonary artery pressure
3. Patients being considered for lung transplantation or other surgical procedure for advanced lung disease*

Class III

1. Lung disease without any clinical suspicion of cardiac involvement

2. Re-evaluation studies of RV function in patients with chronic obstructive lung disease without a change in clinical status

*TEE is indicated when TTE studies are not diagnostic.

Recommendations for Echocardiography in Hypertension

Class I

1. When assessment of resting LV function, hypertrophy, or concentric remodeling is important in clinical decision making (see LV function)
2. Detection and assessment of functional significance of concomitant CAD by stress echocardiography (see coronary disease).
3. Follow-up assessment of LV size and function in patients with LV dysfunction when there has been a documented change in clinical status or to guide medical therapy

Class IIa

1. Identification of LV diastolic filling abnormalities with or without systolic abnormalities
2. Assessment of LV hypertrophy in a patient with borderline hypertension without LV hypertrophy on ECG to guide decision making regarding initiation of therapy. A limited goal-directed echocardiogram may be indicated for this purpose.

Class IIb

Risk stratification for prognosis by determination of LV performance

Class III

1. Re-evaluation to guide antihypertensive therapy based on LV mass regression
2. Re-evaluation in asymptomatic patients to assess LV function

Recommendations for Echocardiography in Patients With Neurological Events or Other Vascular Occlusive Events

Class I

1. Patients of any age with abrupt occlusion of a major peripheral or visceral artery
2. Younger patients (typically less than 45 years) with cerebrovascular events
3. Older patients (typically more than 45 years) with neurological events without evidence of cerebrovascular disease or other obvious cause
4. Patients for whom a clinical therapeutic decision (e.g., anticoagulation) will depend on the results of echocardiography.

Class IIa

Patients with suspicion of embolic disease and with cerebrovascular disease of questionable significance

Class IIb

Patients with a neurological event and intrinsic cerebrovascular disease of a nature sufficient to cause the clinical event

Class III

Patients for whom the results of echocardiography will not impact a decision to institute anticoagulant therapy or otherwise alter the approach to diagnosis or treatment

Recommendations for Echocardiography in Patients With Arrhythmias and Palpitations

Class I

1. Arrhythmias with clinical suspicion of structural heart disease
2. Arrhythmia in a patient with a family history of a genetically transmitted cardiac lesion associated with arrhythmia, such as tuberous sclerosis, rhabdomyoma, or hypertrophic cardiomyopathy
3. Evaluation of patients as a component of the workup before electrophysiological ablative procedures

Class IIa

1. Arrhythmia requiring treatment
2. TEE or intracardiac ultrasound guidance of radiofrequency ablative procedures

Class IIb

1. Arrhythmias commonly associated with, but without clinical evidence of, heart disease
2. Evaluation of patients who have undergone radiofrequency ablation in the absence of complications (In centers with established ablation programs, a postprocedural echocardiogram may not be necessary.)
3. Postoperative evaluation of patients undergoing the Maze procedure to monitor atrial function

Class III

1. Palpitation without corresponding arrhythmia or other cardiac signs or symptoms
2. Isolated premature ventricular contractions for which there is no clinical suspicion of heart disease

Recommendations for Echocardiography Before Cardioversion

Class I

1. Patients requiring urgent (not emergent) cardioversion for whom extended precardioversion anticoagulation is not desirable*
2. Patients who have had prior cardioembolic events thought to be related to intra-atrial thrombus*
3. Patients for whom anticoagulation is contraindicated and for whom a decision about cardioversion will be influenced by TEE results*
4. Patients for whom intra-atrial thrombus has been demonstrated in previous TEE*
5. Evaluation of patients for whom a decision concerning cardioversion will be impacted by knowledge of prognostic factors (such as LV function or coexistent mitral valve disease)

Class IIa

Patients with atrial fibrillation of less than 48 hours' duration and other heart disease*

Class IIb

1. Patients with atrial fibrillation of less than 48 hours' duration and no other heart disease*
2. Patients with mitral valve disease or hypertrophic cardiomyopathy who have been on long-term anticoagulation at therapeutic levels before cardioversion unless there are other reasons for anticoagulation (e.g., prior embolus or known thrombus on previous TEE)*
3. Patients undergoing cardioversion from atrial flutter*

Class III

1. Patients requiring emergent cardioversion
2. Patients who have been on long-term anticoagulation at therapeutic levels and who do not have mitral valve disease or hypertrophic cardiomyopathy before cardioversion unless there are other reasons for anticoagulation (e.g., prior embolus or known thrombus on previous TEE)*
3. Precardioversion evaluation of patients who have undergone previous TEE and with no clinical suspicion of a significant interval change

*TEE only.

Recommendations for Echocardiography in the Patient With Syncope

Class I

1. Syncope in a patient with clinically suspected heart disease
2. Periexertional syncope

Class IIa

Syncope in a patient in a high-risk occupation (e.g., pilot).

Class IIb

Syncope of occult etiology with no findings of heart disease on history or physical examination

Class III

1. Recurrent syncope in a patient in whom previous echocardiographic or other testing demonstrated a cause of syncope
2. Syncope in a patient for whom there is no clinical suspicion of heart disease
3. Classic neurogenic syncope

Recommendations for Echocardiography to Screen for the Presence of Cardiovascular Disease

Class I

1. Patients with a family history of genetically transmitted cardiovascular disease
2. Potential donors for cardiac transplantation
3. Patients with phenotypic features of Marfan syndrome or related connective tissue diseases
4. Baseline and re-evaluations of patients undergoing chemotherapy with cardiotoxic agents
5. First-degree relatives (parents, siblings, children) of patients with unexplained dilated cardiomyopathy in whom no etiology has been identified

Class IIb

Patients with systemic disease that may affect the heart

Class III

1. The general population
2. Routine screening echocardiogram for participation in competitive sports in patients with normal cardiovascular history, ECG, and examination

Recommendations for Echocardiography in the Critically Ill

Class I

1. The hemodynamically unstable patient
2. Suspected aortic dissection (TEE)

Class III

1. The hemodynamically stable patient not expected to have cardiac disease
2. Re-evaluation follow-up studies on hemodynamically stable patients

Recommendations for Echocardiography in the Critically Injured*

Class I

1. Serious blunt or penetrating chest trauma (suspected pericardial effusion or tamponade)
2. Mechanically ventilated multiple-trauma or chest trauma patient
3. Suspected pre-existing valvular or myocardial disease in the trauma patient
4. The hemodynamically unstable multiple-injury patient without obvious chest trauma but with a mechanism of injury suggesting potential cardiac or aortic injury (deceleration or crush)
5. Widening of the mediastinum, postinjury suspected aortic injury (TEE)
6. Potential catheter, guidewire, pacer electrode, or pericardiocentesis needle injury with or without signs of tamponade

Class IIa

1. Evaluation of hemodynamics in multiple-trauma or chest trauma patients with pulmonary artery catheter monitoring and data disparate with clinical situation
2. Follow-up study on victims of serious blunt or penetrating trauma

Class III

Suspected myocardial contusion in the hemodynamically stable patient with a normal ECG who has no abnormal cardiac/thoracic physical findings and/or lacks a mechanism of injury suggesting cardiovascular contusion

*The use of TTE or TEE includes Doppler techniques when indicated and available and with appropriately trained and experienced sonographer and interpreter.

TEE is indicated when TTE images are suboptimal. TEE often provides incremental information.

Recommendations for Echocardiography in the Adult Patient With Congenital Heart Disease

Class I

1. Patients with clinically suspected congenital heart disease, as evidenced by signs and symptoms such as a murmur, cyanosis, or unexplained arterial desaturation, and an abnormal ECG or radiograph suggesting congenital heart disease
2. Patients with known congenital heart disease on follow-up when there is a change in clinical findings
3. Patients with known congenital heart disease for whom there is uncertainty as to the original diagnosis or when the precise nature of the structural abnormalities or hemodynamics is unclear
4. Periodic echocardiograms in patients with known congenital heart lesions and for whom ventricular function and atrioventricular valve regurgitation must be followed (e.g., patients with a functional single ventricle after Fontan procedure, transposition of the great vessels after Mustard procedure, L-transposition and ventricular inversion, and palliative shunts)
5. Patients with known congenital heart disease for whom following pulmonary artery pressure is important (e.g., patients with hemodynamically important,

moderate, or large ventricular septal defects, atrial septal defects, single ventricle, or any of the above with an additional risk factor for pulmonary hypertension)
6. Periodic echocardiography in patients with repaired (or palliated) congenital heart disease with the following: change in clinical condition or clinical suspicion of residual defects, obstruction of conduits and baffles, LV or RV function that must be followed, or when there is a possibility of hemodynamic progression or a history of pulmonary hypertension
7. To direct interventional catheter valvotomy, radiofrequency ablation, and interventions in the presence of complex cardiac anatomy
8. Identification of site of origin and initial course of coronary arteries (TEE may be indicated in some patients)*

Class IIb

A follow-up echocardiographic study, annually or once every 2 years, in patients with known hemodynamically significant congenital heart disease without evident change in clinical condition

Class III

1. Multiple repeat echocardiography in patients with repaired patent ductus arteriosus, atrial septal defect, ventricular septal defect, coarctation of the aorta, or bicuspid aortic valve without change in clinical condition
2. Repeat echocardiography in patients with known hemodynamically insignificant congenital heart lesions (e.g., small atrial septal defect, small ventricular septal defect) without a change in clinical condition

*TEE may be necessary to image both coronary origins in adults.

Recommendations for Neonatal Echocardiography

Class I

1. Cyanosis, respiratory distress, congestive heart failure, or abnormal arterial pulses
2. Chromosomal abnormality or major extracardiac abnormality associated with a high incidence of coexisting cardiac abnormality
3. Lack of expected improvement in cardiopulmonary status in a premature infant with a clinical diagnosis of pulmonary disease
4. Systemic maternal disease associated with neonatal comorbidity
5. Loud or abnormal murmur or other abnormal cardiac finding in an infant
6. Presence of a syndrome associated with cardiovascular disease and dominant inheritance or multiple affected family members
7. Presence of a syndrome associated with heart disease, with or without abnormal cardiac findings, for which an urgent management decision is needed
8. Cardiomegaly on chest radiograph
9. Dextrocardia, abnormal pulmonary or visceral situs by clinical, electrocardiographic, or radiographic examination
10. Arrhythmias or other abnormalities on standard ECG suggesting structural heart disease or peripartum myocardial injury

11. Clinical suspicion of residual or recurrent abnormality, poor ventricular function, pulmonary artery hypertension, thrombus, sepsis, or pericardial effusion after cardiovascular surgical therapy for congenital heart disease
12. Re-evaluation after initiation or termination of medical therapy for pulmonary artery hypertension
13. Re-evaluation during initiation or withdrawal of extracorporeal cardiopulmonary support
14. Nonimmunologic fetal hydrops
15. Follow-up assessment of a neonate with patent ductus arteriosus who has undergone medical or surgical intervention

Class IIa

1. Short, soft murmur at the lower left sternal border in the neonate
2. Failure to thrive in the absence of definite abnormal clinical findings
3. Presence of a syndrome associated with a high incidence of congenital heart disease for which there are no abnormal cardiac findings and no urgency of management decisions

Class III

1. History of nonsustained fetal ectopy in the absence of postpartum arrhythmias
2. Acrocyanosis with normal upper-and-lower extremity pulsed oximetry oxygen saturations

Recommendations for Echocardiography in the Infant, Child, and Adolescent

Class I

1. Atypical or pathological murmur or other abnormal cardiac finding in an infant or older child
2. Cardiomegaly on chest radiograph
3. Dextrocardia, abnormal pulmonary or visceral situs on clinical, electrocardiographic, or radiographic examination
4. Patients with a known cardiac defect, to assess timing of medical or surgical therapy
5. Selection, placement, patency, and monitoring of endovascular devices, as well as identification of intracardiac or intravascular shunting before, during, and after interventional cardiac catheterization
6. Immediate assessment after percutaneous interventional cardiac catheterization procedure
7. Immediate preoperative evaluation for cardiac surgery of a patient with a known cardiac defect to guide cardiac surgical management and inform the patient and family of risks of surgery
8. Patient with known cardiac lesion and change in physical finding
9. Postoperative congenital or acquired heart disease with clinical suspicion of residual or recurrent abnormality, poor ventricular function, pulmonary artery hypertension, thrombus, sepsis, or pericardial effusion

10. Presence of a syndrome associated with cardiovascular disease and dominant inheritance or multiple affected family members (e.g., Marfan syndrome or Ehlers-Danlos syndrome)
11. Patients with a family history of genetically transmitted myocardial disease, with or without abnormal cardiac finding
12. Baseline and follow-up examinations of patients with neuromuscular disorders having known myocardial involvement
13. Exercise-induced precordial chest pain or syncope

Class IIb

Failure to thrive in the absence of definite abnormal clinical findings

Class III

1. In a child or adolescent, an asymptomatic heart murmur identified by an experienced observer as functional or an insignificant cardiovascular abnormality
2. In an otherwise asymptomatic child or adolescent, chest pain identified by an experienced observer as musculoskeletal in origin

Recommendations for Echocardiography in Pediatric Patients With Arrhythmias/Conduction Disturbances

Class I

1. Arrhythmia in the presence of an abnormal cardiac finding
2. Arrhythmia in a patient with a family history of a genetically transmitted cardiac lesion associated with arrhythmia, such as tuberous sclerosis or hypertrophic cardiomyopathy
3. Complete atrioventricular block or advanced second-degree atrioventricular block
4. Complete or high-degree secondary atrioventricular block
5. Arrhythmia requiring treatment

Class IIa

1. Ventricular arrhythmia in a patient referred for evaluation for competitive sports
2. Evidence of pre-excitation on ECG with symptoms

Class IIb

1. Pre-excitation on ECG in the absence of abnormal cardiac findings
2. Recurring arrhythmia not requiring treatment in the presence of normal findings on examination
3. Examination immediately after radiofrequency ablation

Class III

Sinus arrhythmia or isolated extrasystoles in a child with otherwise normal cardiac findings and no family history of a genetically transmitted abnormality associated with arrhythmia

Recommendations for Echocardiography in Pediatric Acquired Cardiovascular Disease

Class I

1. Baseline studies and re-evaluation as clinically indicated on all pediatric patients with suspected or documented Kawasaki disease, myopericarditis, human immunodeficiency virus (HIV), or rheumatic fever
2. After cardiac or cardiopulmonary transplant to monitor for signs of acute or chronic rejection, thrombus, and cardiac growth
3. Baseline and re-evaluation examinations of patients receiving cardiotoxic chemotherapeutic agents
4. Patients with clinical evidence of myocardial disease
5. Patients with severe renal disease and/or systemic hypertension
6. Donors undergoing evaluation for cardiac transplantation

Class IIa

An acutely ill child with suspected bacterial sepsis or rickettsial disease

Class IIb

1. Follow-up examinations after acute rheumatic fever in patients with normal cardiac findings
2. A single late follow-up study after acute pericarditis with no evidence of recurrence or chronic pericardial disease

Class III

1. Routine screening echocardiogram for participation in competitive sports in patients with normal cardiovascular examination
2. Long-term follow-up studies in patients with Kawasaki disease who have no coronary abnormalities during the acute phase of the disease process

Recommendations for Echocardiography in Pediatric Acquired Cardiopulmonary Disease

Class I

1. Any patient with clinical findings of pulmonary artery hypertension
2. Re-evaluation after surgical intervention or initiation of oral and/or parenteral vasodilator therapy for pulmonary artery hypertension
3. Re-evaluation during withdrawal of extracorporeal cardiopulmonary support

Class IIa

Baseline study of patients with cystic fibrosis and no findings of cor pulmonale

Recommendations for Echocardiography in Pediatric Thromboembolic Disease States

Class I

1. Thromboembolic event in an infant, child, or adolescent
2. Finding or family history of tuberous sclerosis
3. Appearance of sepsis, cyanosis, or right-heart failure in a patient with a long-standing indwelling catheter
4. Systemic embolization or acute-onset hypertension in a patient with right-to-left-shunting and an indwelling catheter
5. Superior vena caval syndrome in the presence of central venous catheter

Class IIb

Patient with indwelling catheter and fever but without evidence of pulmonary or systemic embolization

Class III

Routine surveillance of asymptomatic patients with indwelling catheter

Recommendations for TEE in Pediatric Patients

Class I

1. Any patient with congenital or acquired heart disease needing echocardiography when significant diagnostic information cannot be obtained by TTE
2. Monitoring and guidance during cardiothoracic surgical procedures
3. Guidance of catheter/device placement during interventional catheterization/radiofrequency ablation in patients with congenital heart disease
4. Study of patients with intra-atrial baffle in whom the potential for thrombus is of concern because of elevated central venous pressures, atrial chamber dilation, increasing cyanosis, or the appearance of arrhythmia
5. Patients with long-term placement of intravascular devices in whom thrombus or vegetation is suspected
6. Patients with a prosthetic valve in whom thrombus or vegetation is suspected
7. Any patient with suspected endocarditis and inadequate transthoracic acoustical window.
8. Patients with right atrial to pulmonary artery Fontan connection for identification of atrial thrombus

Class IIa

Patients with lateral tunnel Fontan palliation.

Class III

1. Performing TEE in a patient who has not previously had careful study by TTE

2. Patients with structural esophageal abnormality

Recommendations for Fetal Echocardiography

Class I

1. Abnormal-appearing heart on general fetal ultrasound examination
2. Fetal tachycardia, bradycardia, or persistent irregular rhythm on clinical or screening ultrasound examination
3. Maternal/family risk factors for cardiovascular disease, such as a parent, sibling, or first-degree relative with congenital heart disease
4. Maternal diabetes
5. Maternal systemic lupus erythematosus
6. Teratogen exposure during a vulnerable period
7. Other fetal system abnormalities (including chromosomal)
8. Performance of transplacental therapy or presence of a history of significant but intermittent arrhythmia. Re-evaluation examinations are required in these conditions.

Class IIa

Fetal distress or dysfunction of unclear etiology

Class IIb

1. Previous history of multiple fetal losses
2. Multiple gestation

Class III

1. Low-risk pregnancies with normal anatomic findings on ultrasound examination
2. Occasional premature contractions without sustained tachycardia or signs of dysfunction or distress
3. Presence of a noncardiovascular system abnormality when evaluation of the cardiovascular system will not alter either management decisions or fetal outcome.

Recommendations for Intraoperative Echocardiography

Class I

1. Evaluation of acute, persistent, and life-threatening hemodynamic disturbances in which ventricular function and its determinants are uncertain and have not responded to treatment
2. Surgical repair of valvular lesions, hypertrophic obstructive cardiomyopathy, and aortic dissection with possible aortic valve involvement
3. Evaluation of complex valve replacements requiring homografts or coronary reimplantation, such as the Ross procedure
4. Surgical repair of most congenital heart lesions that require cardiopulmonary bypass (CPB)

5. Surgical intervention for endocarditis when preoperative testing was inadequate or extension to perivalvular tissue is suspected
6. Placement of intracardiac devices and monitoring of their position during port-access and other cardiac surgical interventions
7. Evaluation of pericardial window procedures in patients with posterior or loculated pericardial effusions

Class IIa

1. Surgical procedures in patients at increased risk of myocardial ischemia, myocardial infarction, or hemodynamic disturbances
2. Evaluation of valve replacement, aortic atheromatous disease, the Maze procedure, cardiac aneurysm repair, removal of cardiac tumors, intracardiac thrombectomy, and pulmonary embolectomy
3. Detection of air emboli during cardiotomy, heart transplant operations, and upright neurosurgical procedures

Class IIb

1. Evaluation of suspected cardiac trauma, repair of acute thoracic aortic dissection without valvular involvement, and anastomotic sites during heart and/or lung transplantation
2. Evaluation of regional myocardial function during and after off-pump coronary artery bypass graft (CABG) procedures
3. Evaluation of pericardiectomy, pericardial effusions, and pericardial surgery
4. Evaluation of myocardial perfusion, coronary anatomy, or graft patency
5. Dobutamine stress testing to detect inducible demand ischemia or to predict functional changes after myocardial revascularization
6. Assessment of residual duct flow after interruption of patent ductus arteriosus

Class III

Surgical repair of uncomplicated secundum atrial septal defect

Definitions:

Class I: Conditions for which there is evidence and/or general agreement that a given procedure or treatment is useful and effective

Class II: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment

Class IIa: Weight of evidence/opinion is in favor of usefulness/efficacy.

Class IIb: Usefulness/efficacy is less well established by evidence/opinion.

Class III: Conditions for which there is evidence and/or general agreement that the procedure/treatment is not useful/effective and in some cases may be harmful*

*Because it is not likely that harm will occur by performing an echocardiogram, the reason for the Class III designation in this guideline is almost exclusively that there is no evidence that performing an echocardiogram has been shown to be helpful.

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

Recommendations are based on either evidence from observational studies or on the expert consensus of the committee.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

- Promote appropriate utilization of echocardiography in the diagnosis and evaluation of cardiovascular disease
- Prevent indiscriminant use of echocardiography as a screening tool and therefore prevent costly and unnecessary additional testing or inappropriate therapy
- Decrease cardiovascular morbidity and mortality due to the contribution of echocardiography in diagnosis, risk assessment, evaluation of disease severity, and monitoring of therapy

POTENTIAL HARMS

- Transesophageal echocardiography (TTE) is associated with little if any patient discomfort, and no risks with this procedure have been identified. The use of TTE with exercise or vasoactive drugs such as dipyridamole or dobutamine involves the minimal risks of arrhythmia, ischemia and hypotension seen with exercise and the aforementioned drugs.
- TEE involves some discomfort and minimal but definite risk of pharyngeal and esophageal trauma and even rarely esophageal perforation. Rare instances of infective endocarditis and an occasional reaction to either the sedative or local anesthesia has been associated with the use of TEE.
- Intraoperative TEE is not without risks. Hogue et al. studied independent predictors of swallowing dysfunction after cardiac surgery. In addition to age and length of intubation after surgery, intraoperative use of TEE was a highly significant (P less than 0.003) predictor of swallowing dysfunction. In another study of 838 consecutive cardiac surgical patients, significant factors causing postoperative dysphagia were studied by multiple logistic regression. After controlling for other significant factors such as stroke, left ventricular ejection fraction, intubation time, and duration of operation, the patients with intraoperative TEE had 7.8 times greater odds of dysphagia than those without.

- Greene et al. evaluated the safety of TEE in pediatric cardiac surgery by performing an endoscopic examination of the esophagus after TEE. In 50 patients undergoing repair of congenital cardiac defects, the endoscopic examination was performed after removal of the TEE probe. In 32 patients, mild mucosal injury was observed, but none resulted in long-term feeding or swallowing difficulties.
- There are specific populations where special training and experience are required to perform and interpret echocardiography: a) fetuses, infants, and pediatric populations, especially evaluating congenital heart disease; b) performing TEE in infants and children where the chances of pharyngeal and esophageal trauma are greatest.

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

- These guidelines attempt to define practices that meet the needs of most patients in most circumstances. The ultimate judgment regarding care of a particular patient must be made by the physician and patient in light of all the circumstances presented by that patient.
- When faced with a patient needing cardiovascular evaluation and testing, the clinician must choose among available tests. Echocardiography, nuclear testing, magnetic resonance imaging (MRI), and positron emission tomography can yield overlapping if not identical information, often with similar or comparable accuracy. Decisions concerning which technique to use must then be based on such factors as local expertise in performance and interpretation, test availability, cost, and patient preference. Therefore, it is impossible in this document to judge competing tests or recommend the use of one over another.
- It is easier to state when a repeat echocardiogram is not needed then when and how often it should be repeated since no studies in the literature address this question. The need to repeat echocardiography in certain clinical scenarios must be left to the judgement of the physician until evidence-based data addressing this issue are available.
- This document assumes that echocardiographic studies are performed and interpreted in accordance with the statements for clinical competence in echocardiography set forth by the Joint Task Force of the American College of Physicians/American College of Cardiology/American Heart Association. Optimal training for such studies is set forth by the American Society of Echocardiography, the American College of Cardiology, and the Society of Pediatric Echocardiography.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better
Living with Illness

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

ACC/AHA/ASE 2003 guideline update for the clinical application of echocardiography: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines [trunc]. Bethesda (MD): American College of Cardiology Foundation; 2003. 99 p. [858 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1997 Mar 18 (revised 2003 Aug)

GUIDELINE DEVELOPER(S)

American College of Cardiology Foundation - Medical Specialty Society
American Heart Association - Professional Association
American Society of Echocardiography - Professional Association

SOURCE(S) OF FUNDING

The American College of Cardiology and the American Heart Association. No outside funding accepted.

GUIDELINE COMMITTEE

American College of Cardiology (ACC)/American Heart Association (AHA)/American Society of Echocardiography (ASE) Committee to Update the 1997 Guidelines for the Clinical Application of Echocardiography

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

The committee was composed of both university-affiliated and practicing physicians and those with specific echocardiographic expertise and senior clinicians who use the technique. Two general physicians (one general internal medicine and one family practitioner) also served on the committee.

Committee Members: Melvin D. Cheitlin, MD, FACC (Chair); William F. Armstrong, MD, FACC, FAHA; Gerard P. Aurigemma, MD, FACC, FAHA; George A. Beller, MD, FACC, FAHA; Fredrick Z. Bierman, MD, FACC; Jack L. Davis, MD, FACC; Pamela S. Douglas, MD, FACC, FAHA, FASE; David P. Faxon, MD, FACC, FAHA; Linda D. Gillam, MD, FACC, FAHA; Thomas R. Kimball, MD, FACC; William G. Kussmaul, MD, FACC; Alan S. Pearlman, MD, FACC, FAHA, FASE; John T. Philbrick, MD, FACP; Harry Rakowski, MD, FACC, FASE; Daniel M. Thys, MD, FACC, FAHA

Task Force Members: Elliott M. Antman, MD, FACC, FAHA (Chair); Sidney C. Smith, Jr., MD, FACC, FAHA (Vice Chair); Joseph S. Alpert, MD, FACC, FAHA; Jeffrey L. Anderson, MD, FACC; David P. Faxon, MD, FACC, FAHA; Valentin Fuster, MD, PhD, FACC, FAHA; Raymond J. Gibbons, MD, FACC, FAHA*#; Gabriel Gregoratos, MD, FACC, FAHA; Loren F. Hiratzka, MD, FACC, FAHA; Sharon Ann Hunt, MD, FACC, FAHA; Alice K. Jacobs, MD, FACC, FAHA; Richard O. Russell, MD, FACC, FAHA*

*Former Task Force Member
#Immediate Past Task Force Chair

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

The American College of Cardiology (ACC)/American Heart Association (AHA) Task Force on Practice Guidelines makes every effort to avoid any actual or potential conflicts of interest that might arise as a result of an outside relationship or personal interest of a member of the writing panel. Specifically, all members of the writing panel are asked to provide disclosure statements of all such relationships that might be perceived as real or potential conflicts of interest.

These statements are reviewed by the parent task force, reported orally to all members of the writing panel at the first meeting, and updated as changes occur.

ACC/AHA/American Society of Echocardiography Writing Committee to Update the 1997 Guidelines on the Clinical Application of Echocardiography - Relationships with Industry:

- Dr. George A. Beller has served as a consultant for BMS
- Dr. Pamela S. Douglas has received a research grant from Agilent Technologies

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Cheitlin MD, Alpert JS, Armstrong WF, Aurigemma GP, Beller GA, Bierman FZ, Davidson TW, Davis JL, Douglas PS, Gillam LD, et al. ACC/AHA guidelines for the clinical application of

echocardiography. A report of the American College of Cardiology American Heart Association Task Force on Practice Guidelines: Committee on Clinical Application of Echocardiography. Circulation 1997 Mar 18;95(6):1686-744.

GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the American College of Cardiology (ACC) Web site. Also available in PDF Format from the American Heart Association (AHA) Web site.

Print copies: Available from ACC, Educational Services, 9111 Old Georgetown Road, Bethesda, MD 20814-1699. Also available from AHA, Public Information 7272 Greenville Avenue, Dallas, TX 75231-4596 (Reprint No. 71-0112).

AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

- ACC/AHA/ASE 2003 guideline update for the clinical application of echocardiography: summary article. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (ACC/AHA/ASE Committee to Update the 1997 Guidelines for the Clinical Application of Echocardiography. Circulation 2003 Sep 2;108(9):1146-62.

Electronic copies: Available in Portable Document Format (PDF) from the American College of Cardiology (ACC) Web site. Copies also available in HTML format from the American Heart Association (AHA) Web site.

Print copies: Available from ACC, Resource Center, 9111 Old Georgetown Rd, Bethesda, MD 20814-1699; (800) 253-4636 (US only). Also available from AHA, Public Information, 7272 Greenville Ave, Dallas TX 75231-4596.

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on June 30, 1998. The information was verified by the guideline developer on December 1, 1998. This summary was updated by ECRI on March 8, 2004. The updated information was verified by the guideline developer on April 21, 2005.

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